NGST Systems Engineering Report

Thermal Subsystem 05

Title: **OTA Temperature Sensitivity to Sunshield Inner Layer Emittance**	
Date: 5/4/98	Number: THSER05
Prepared by: Keith Parrish/NGST Thermal Systems Lead	
Concurrence: Paul Geithner/NGST Mission Systems Engineer	
References:	

Description

A simple parametric thermal analysis was conducted using the NASA Yardstick baseline EOL thermal model to examine the effect of inner layer shade emittance on the OTA's primary mirror temperature. The sunshield relies on low emittance vapor deposited aluminum(VDA) to minimize heat transfer between layers and to enhance heat rejection via reflection to space from between the layers. The baseline model assumes an inner layer emittance of 0.03. However, since this value can vary significantly due to measurement error, manufacturing tolerance, or contamination, the effects of emittance values higher than 0.03 were examined.

Results Summary

Figure 1 illustrates the rise in the primary mirror's average temperature if the emittance on each inner layer is raised above the baseline value of 0.03 up to 0.1. The results indicate a dramatic sensitivity to the inner layers' emittances. Measured emittances for VDA of up to 0.07 are not uncommon. The results indicate that this crucial parameter must be carefully considered in the design and analysis of the NGST's sunshield.

Detailed Discussion

The analysis was conducted by taking the baseline NASA NGST Yardstick six layer baseline and raising the emittance of each inner sunshield layer up from the baseline value of 0.03. As with the baseline analysis the parametric analyses assumed completely diffuse thermo-optical properties on the sunshield layers. Results indicate that inner layer shield emittance values are extremely critical to the shades thermal performance. A shield with wider layer spacing or additional layers might not be as sensitive to this type of degradation. Also, the assumption of purely diffuse properties may also instigate the rapid degradation in performance. In addition to contamination from either ground handling, outgassing, or micrometeoroid damage, surface mounted shield reinforcements would also increase the shields inner layer emittance. The use of redundant layers, i.e. in the case of a non-deploy or a failed or badly torn sun facing layer, would also increase a layer's emittance and thus degrade thermal performance.

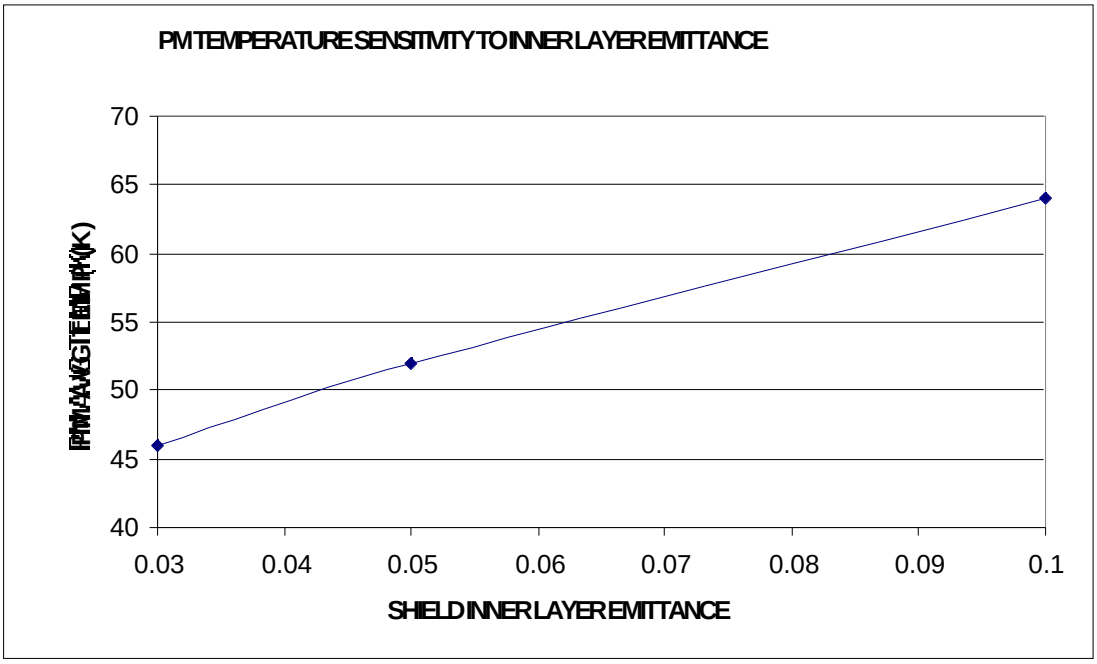
PM TEMPERATURE SENSITIVITY TO INNER LAYER EMITTANCE
70
65
60
55
50
45
40
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1
SHIELD INNER LAYER EMITTANCE

Figure 1